Architecture 100

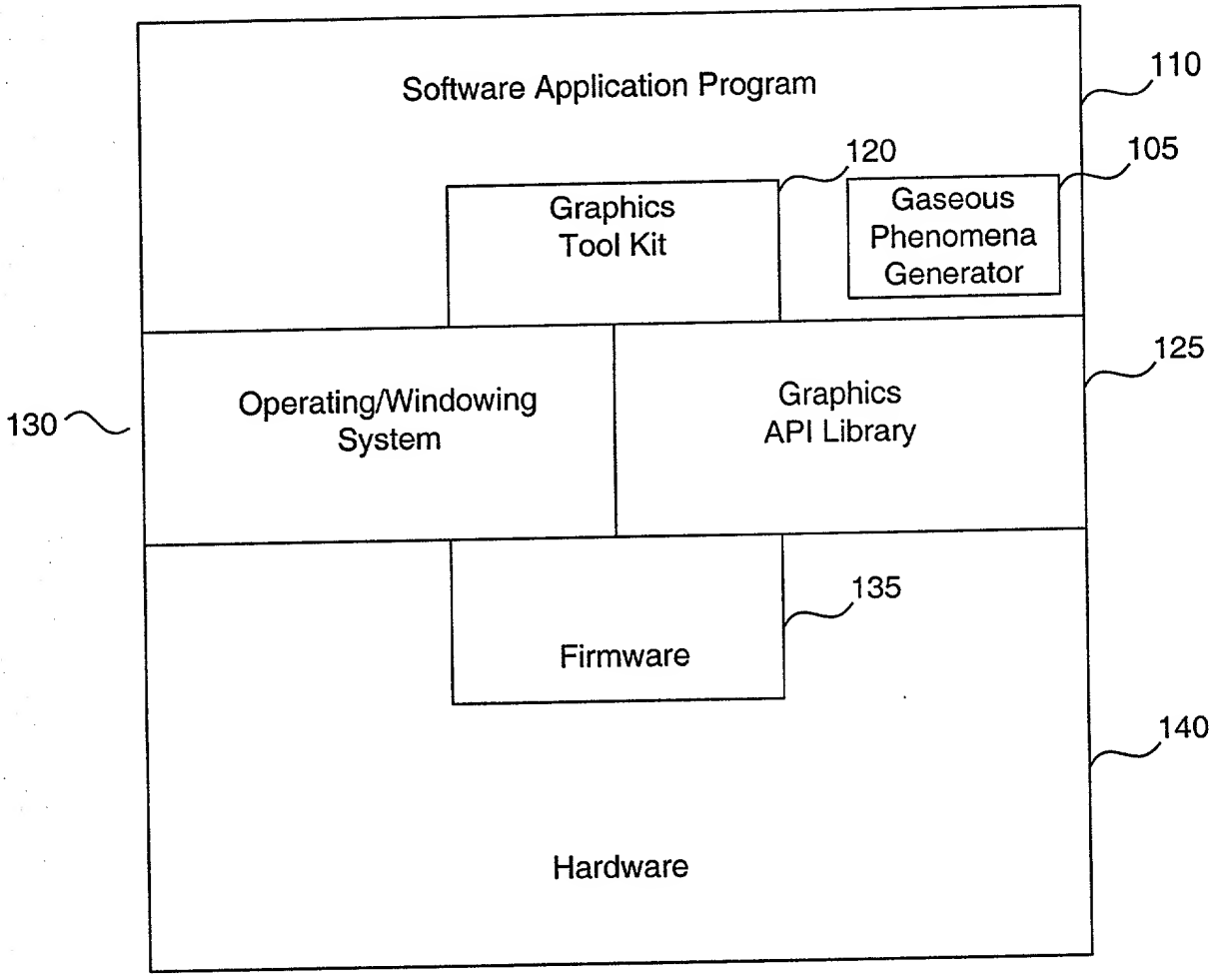


FIG. 1

09/960065 - 11/21/01

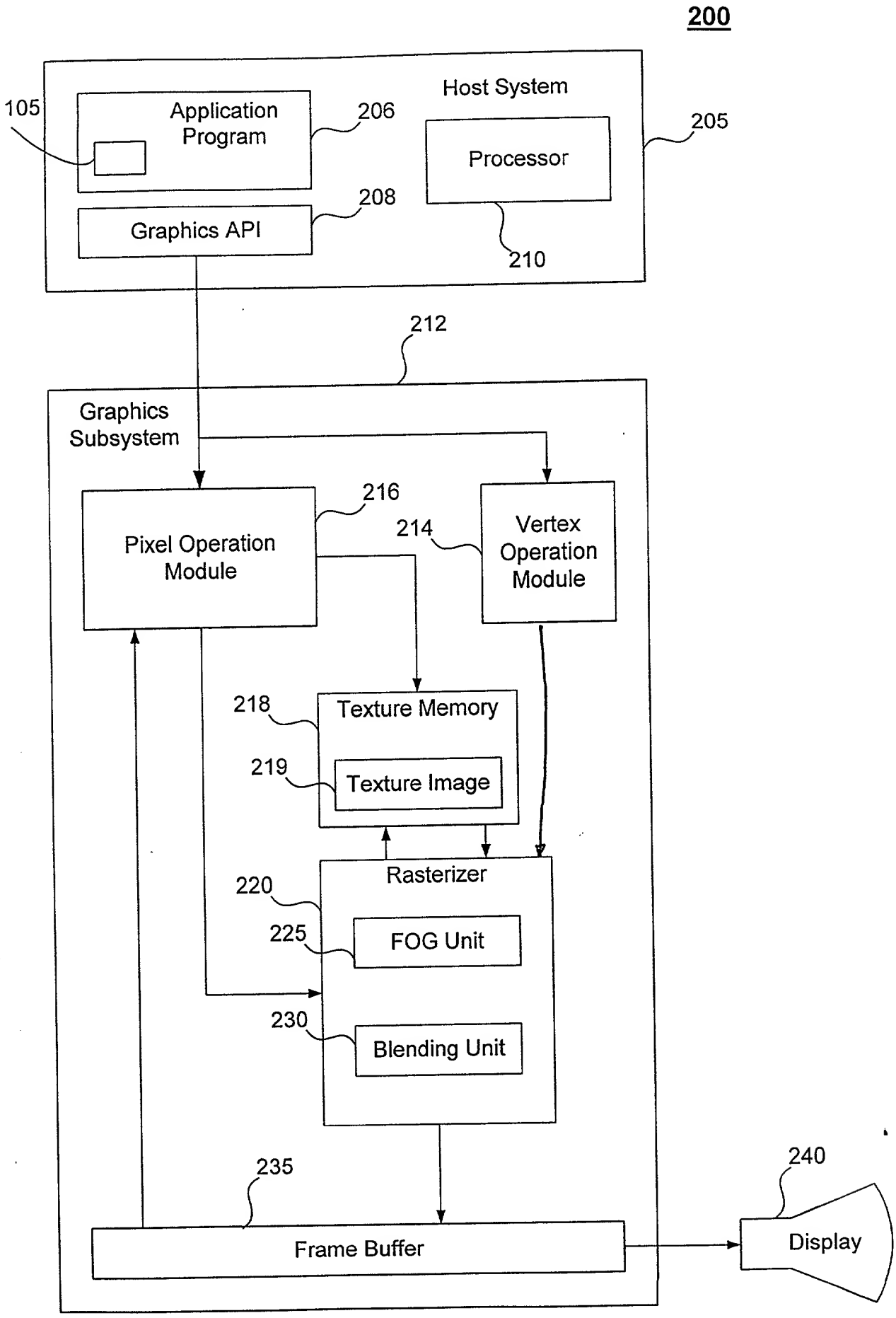


FIG. 2

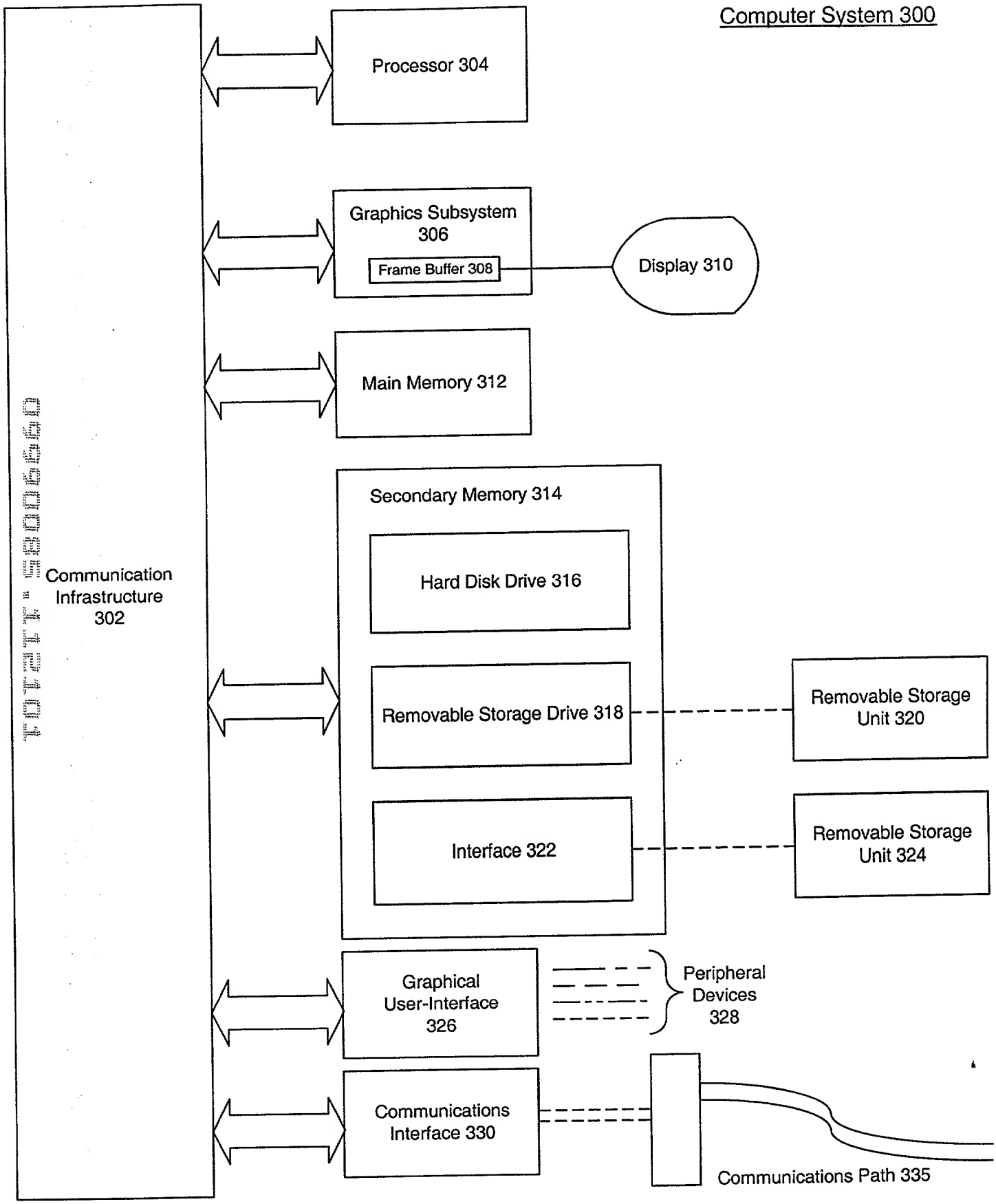
Computer System 300
Processor 304
Graphics Subsystem 306
Frame Buffer 308
Display 310
Main Memory 312
Secondary Memory 314
Hard Disk Drive 316
Removable Storage Drive 318
Removable Storage Unit 320
Interface 322
Removable Storage Unit 324
Communication Infrastructure 302
Graphical User-Interface 326
Peripheral Devices 328
Communications Interface 330
Communications Path 335

FIG. 3

09900835 - 121204

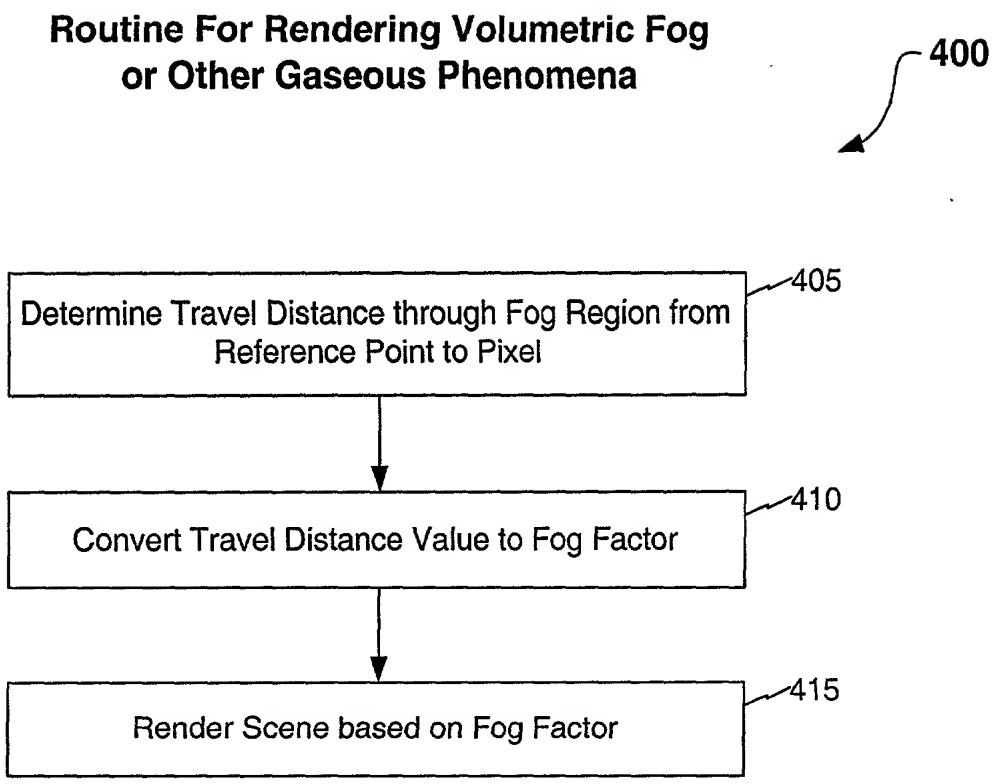


FIG. 4

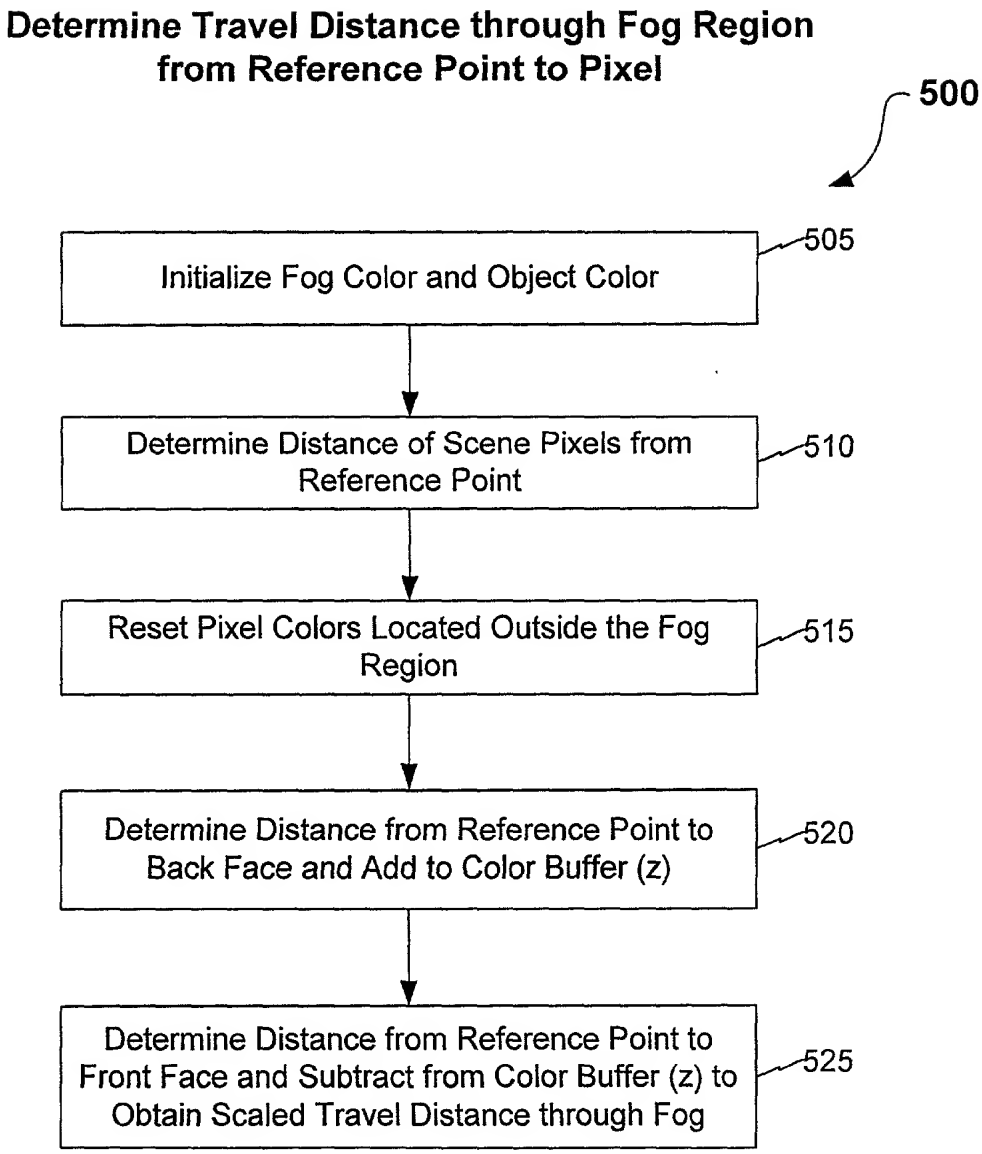


FIG. 5

0003-88.vsd/5

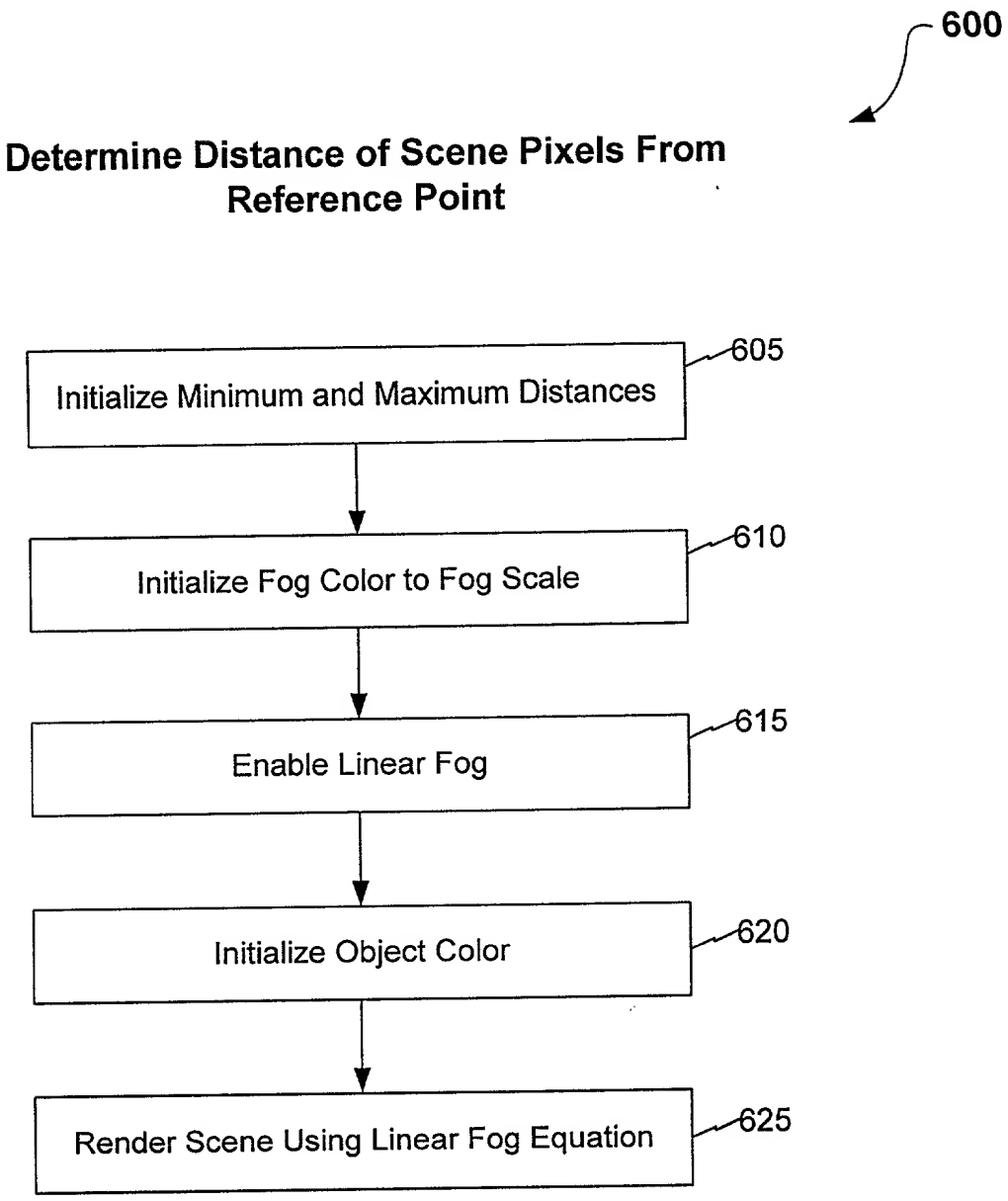
600
Determine Distance of Scene Pixels From Reference Point
Initialize Minimum and Maximum Distances
605
Initialize Fog Color to Fog Scale
610
Enable Linear Fog
615
Initialize Object Color
620
Render Scene Using Linear Fog Equation
625

FIG. 6

## Linear Fog Equation

Equation One (1)

$$\text{Attenuation Factor}(f) = \frac{\text{Maximum Distance} - \text{Pixel Distance}}{\text{Maximum Distance} - \text{Minimum Distance}}$$

Equation Two (2)

$$\text{Color} = f \bullet \text{Object Color} + (1-f) \bullet \text{Fog Color}$$

Equation Three (3)

$$\text{Color} = \frac{\text{Pixel Distance} - \text{Minimum Distance}}{\text{Maximum Distance} - \text{Minimum Distance}} \bullet \text{Fog Scale}$$

FIG. 7

## Reset Pixel Colors Located Outside the Fog Region

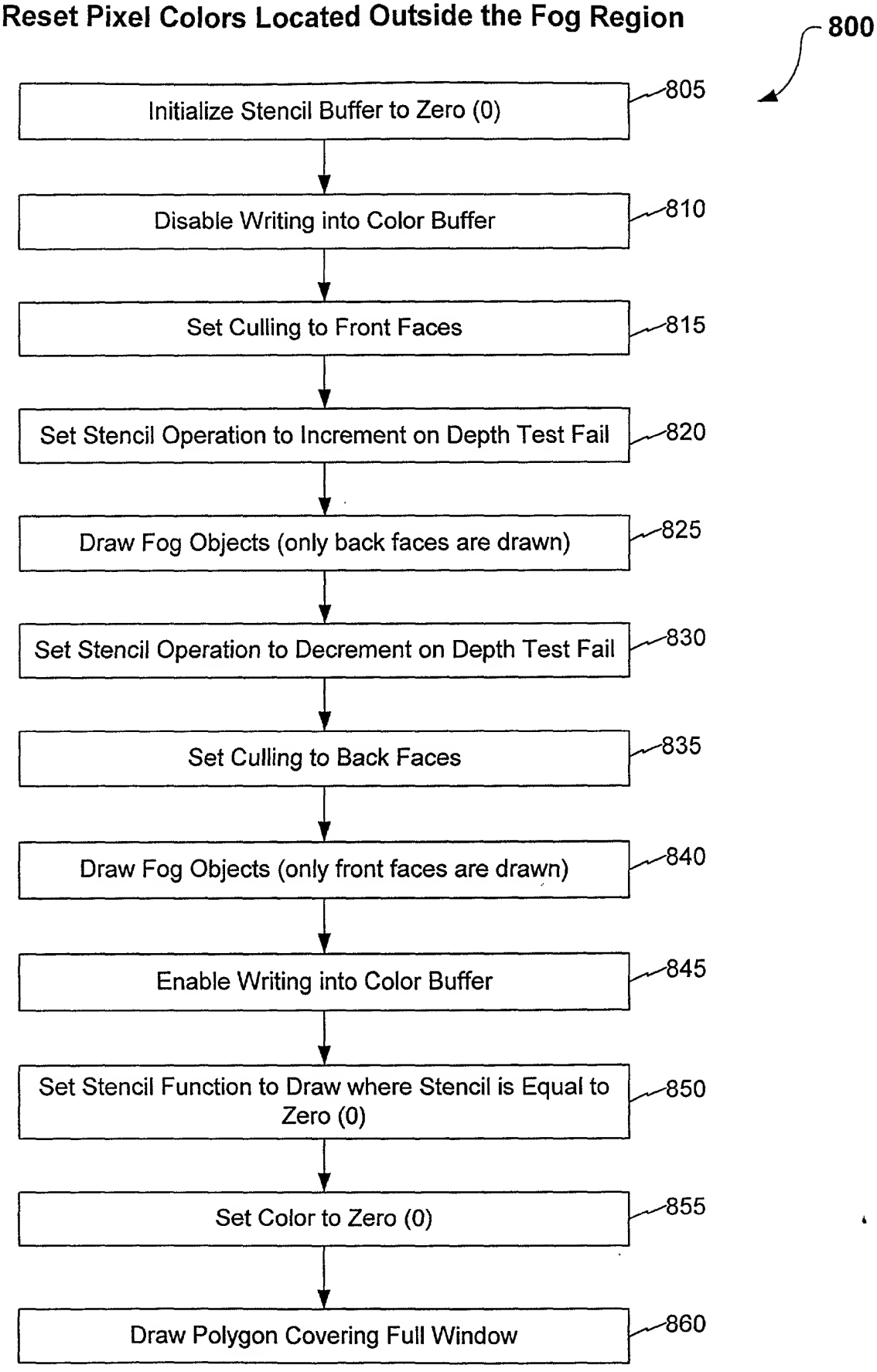


FIG. 8

Google Exhibit 1024 - 1 of 4

## Determine Travel Distance through Fog Region from Reference Point to Pixel

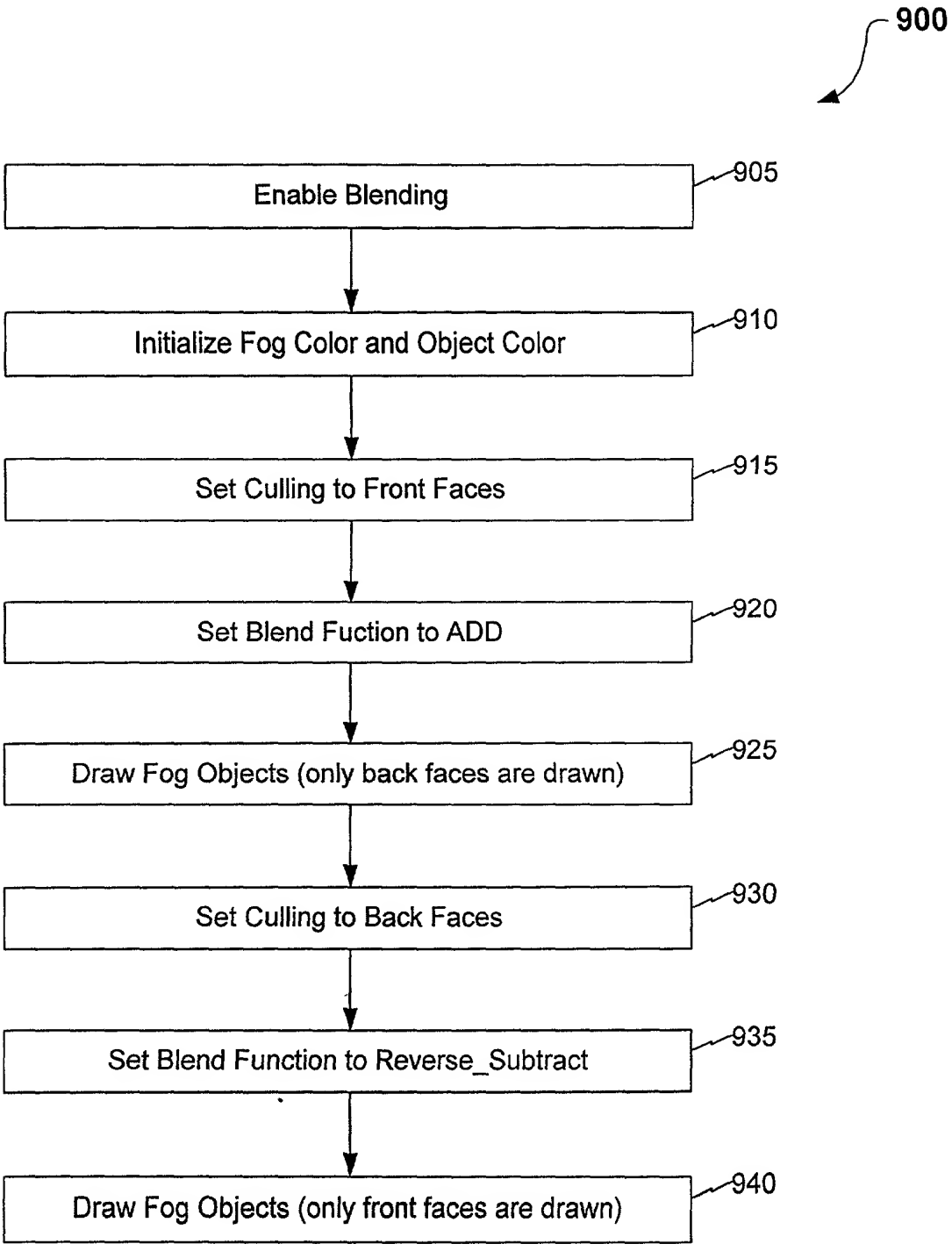


FIG. 9

Patent 5808625

## Render Scene Based on Fog Factor

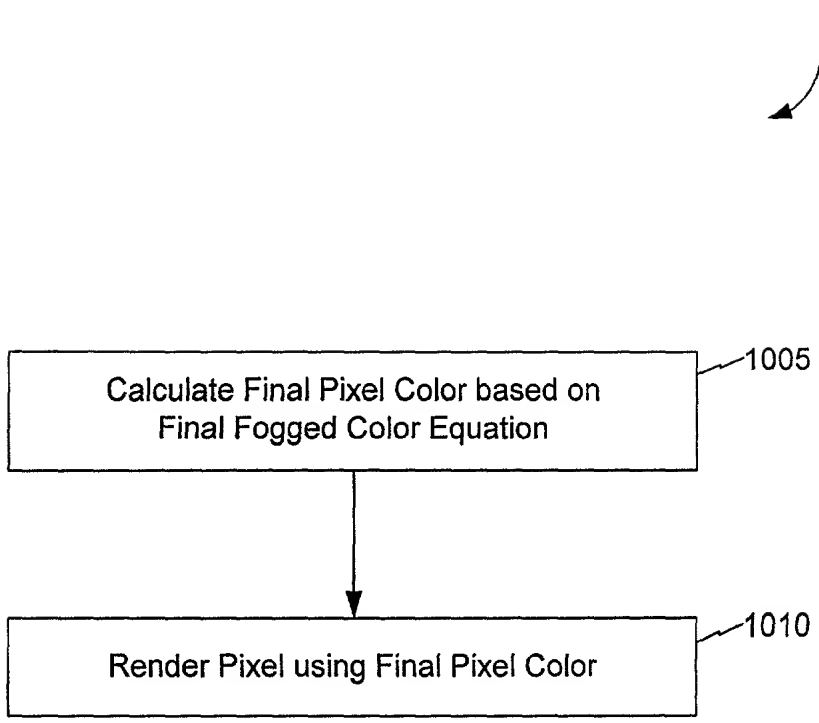


FIG. 10

## Final Fogged Color Equation

| |
|---|
| Unfogged pixel color • fog factor + fog color • (1 - fog factor) |

FIG. 11

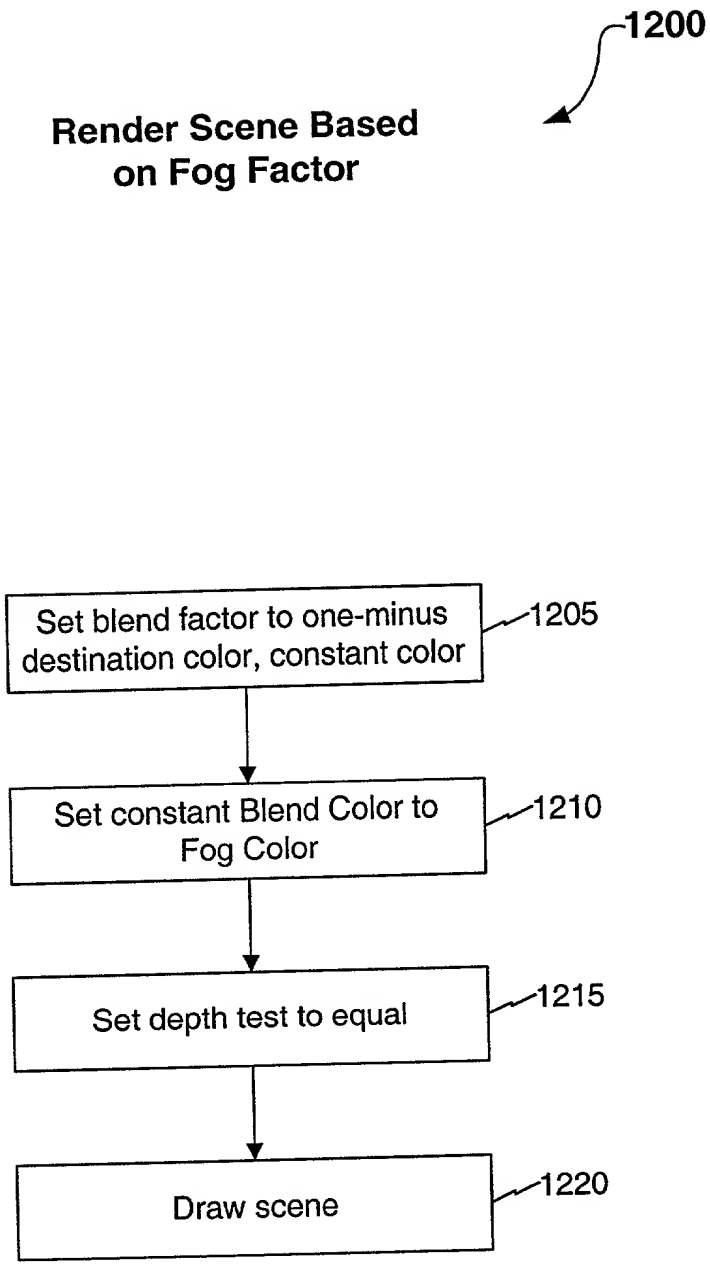
1200
Render Scene Based on Fog Factor
Set blend factor to one-minus destination color, constant color
1205
Set constant Blend Color to Fog Color
1210
Set depth test to equal
1215
Draw scene
1220

FIG. 12

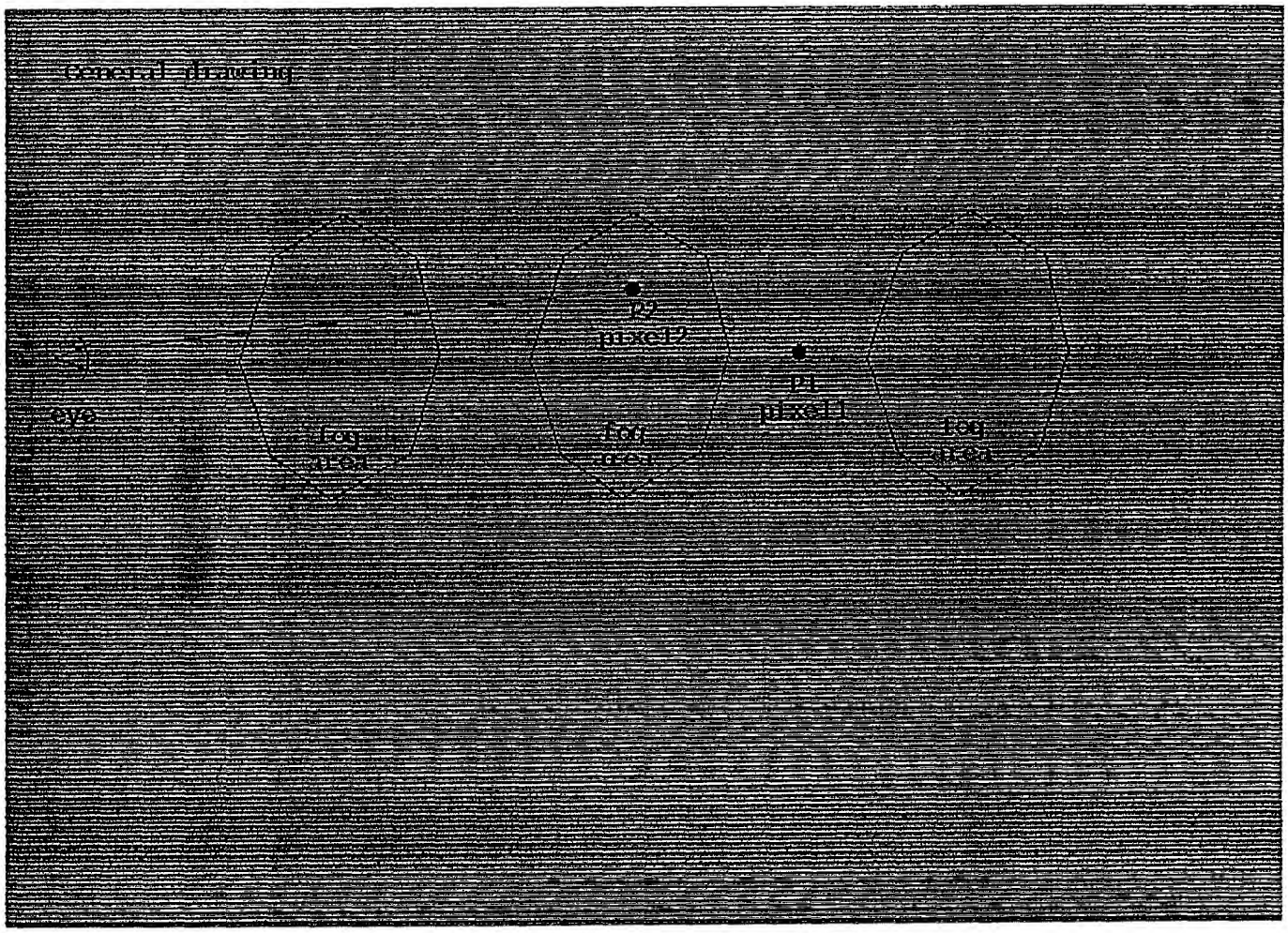
General drawing
eye
p2
pixel2
p1
pixel1
top
plane
top
plane
top
plane

FIG. 13A

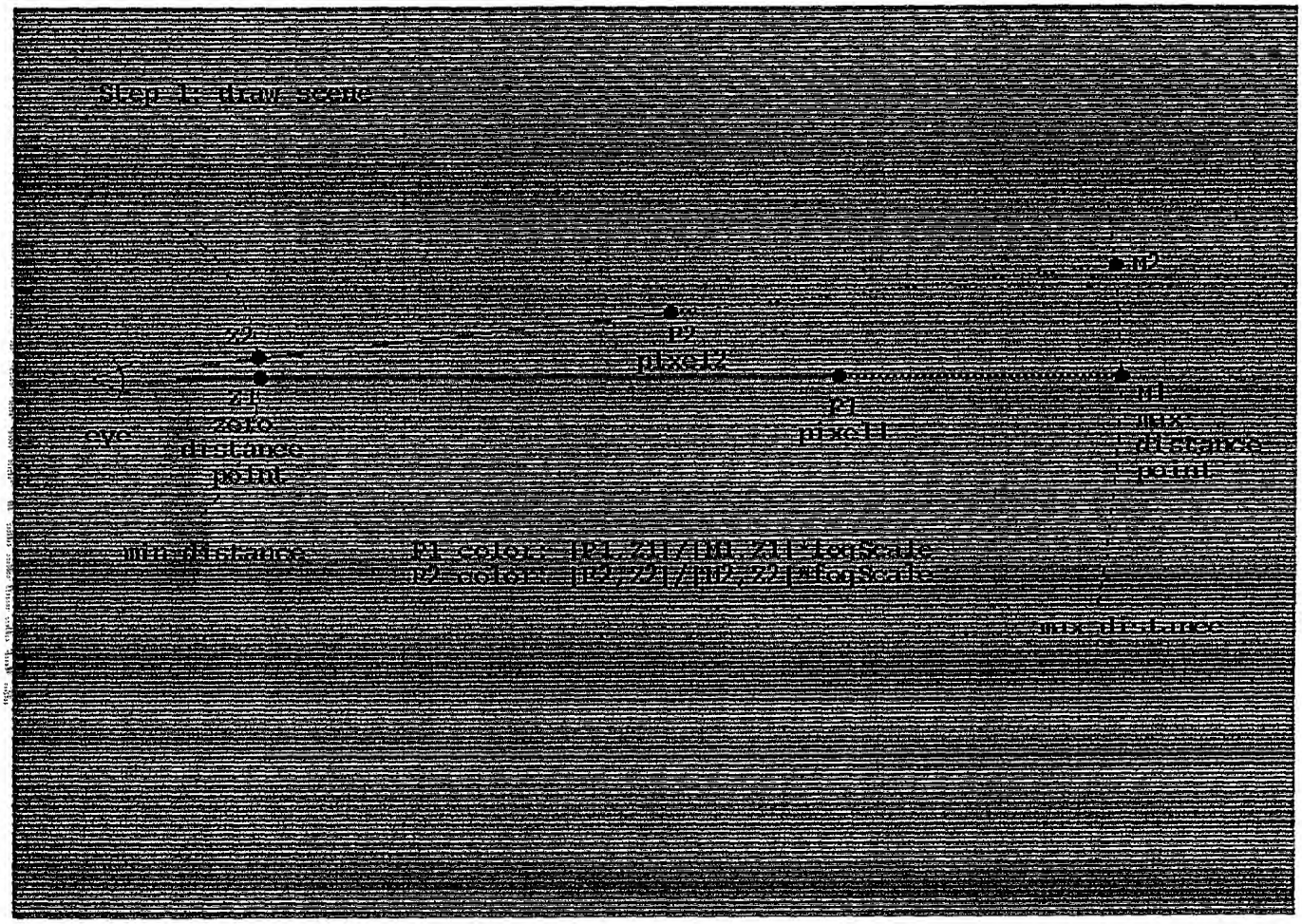
Step 1: draw scene
p2
z2
p1
pixel2
z1
zero-
distance
point
eye
p0
pixel1
m2
max-
distance
point
min-distance
M1 color: [R1,G1,B1,Z1]*fogScale
M2 color: [R2,G2,B2,Z2]*fogScale
max-distance

FIG. 13B

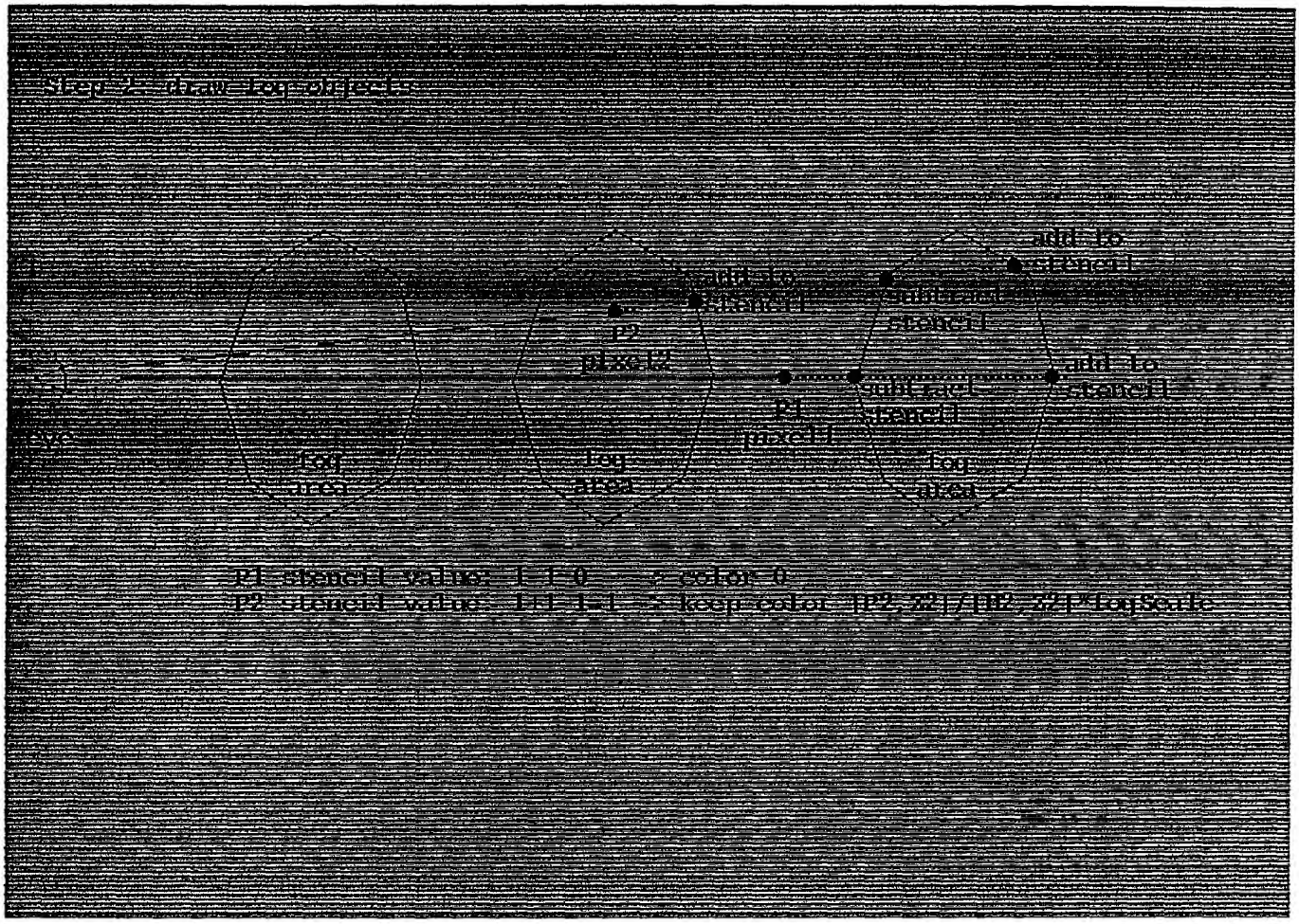
Step 2: draw fog objects
add to stencil
p2
pixel2
p1
pixel1
fog area
P1 stencil value: 1 1 0
P2 stencil value: 1 1 1 1
color 0
keep color if P2, P1 fog scale

FIG. 13C

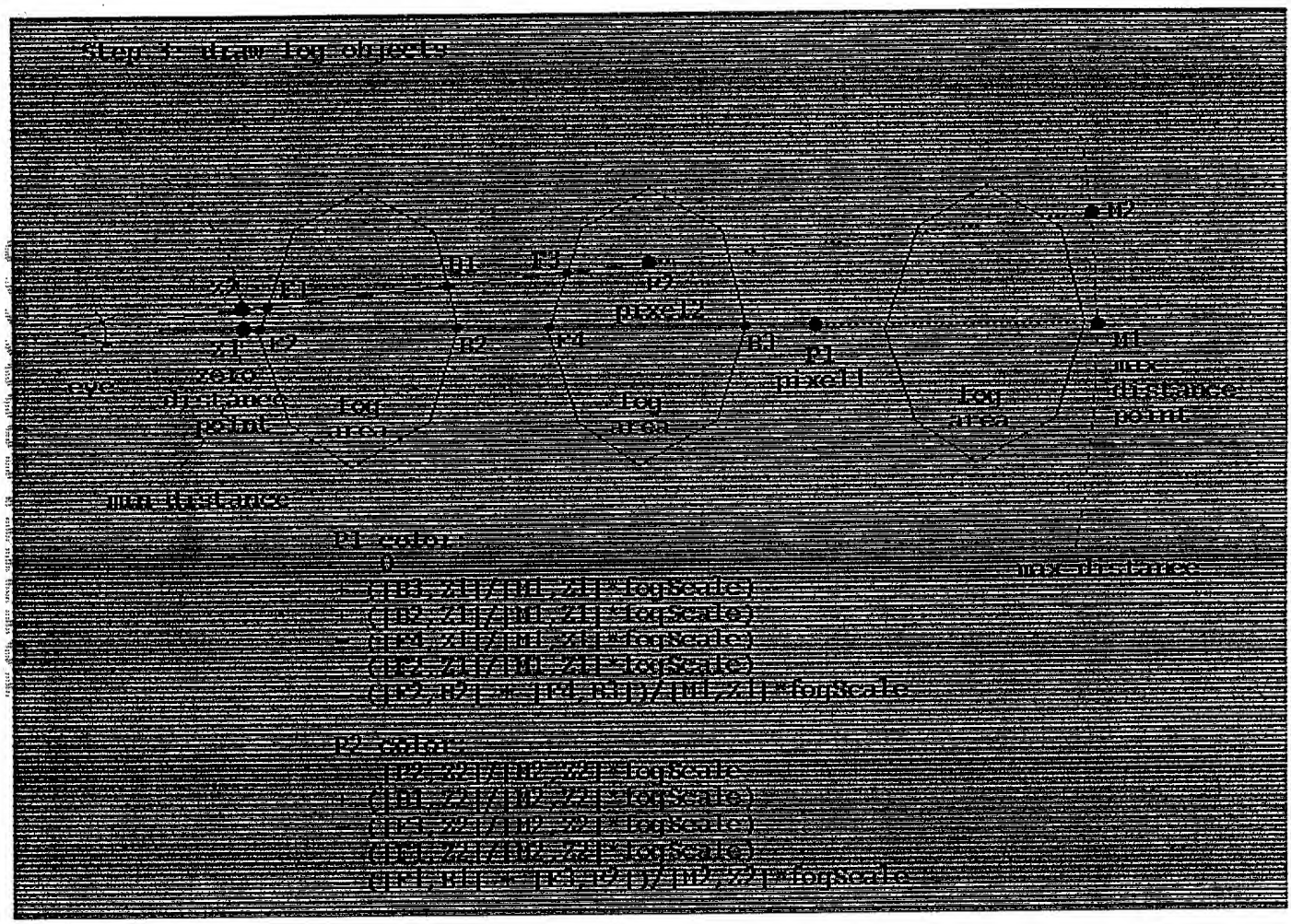
Step 1: draw fog objects
p2
p1
z2
z1
zero
eye
objectance
point
fog
area
min distance
p1 color:
0
p2 color:
p1
pixel2
p4
p3
pixel1
p2
m2
m1
max
distance
point
max distance

FIG. 13D

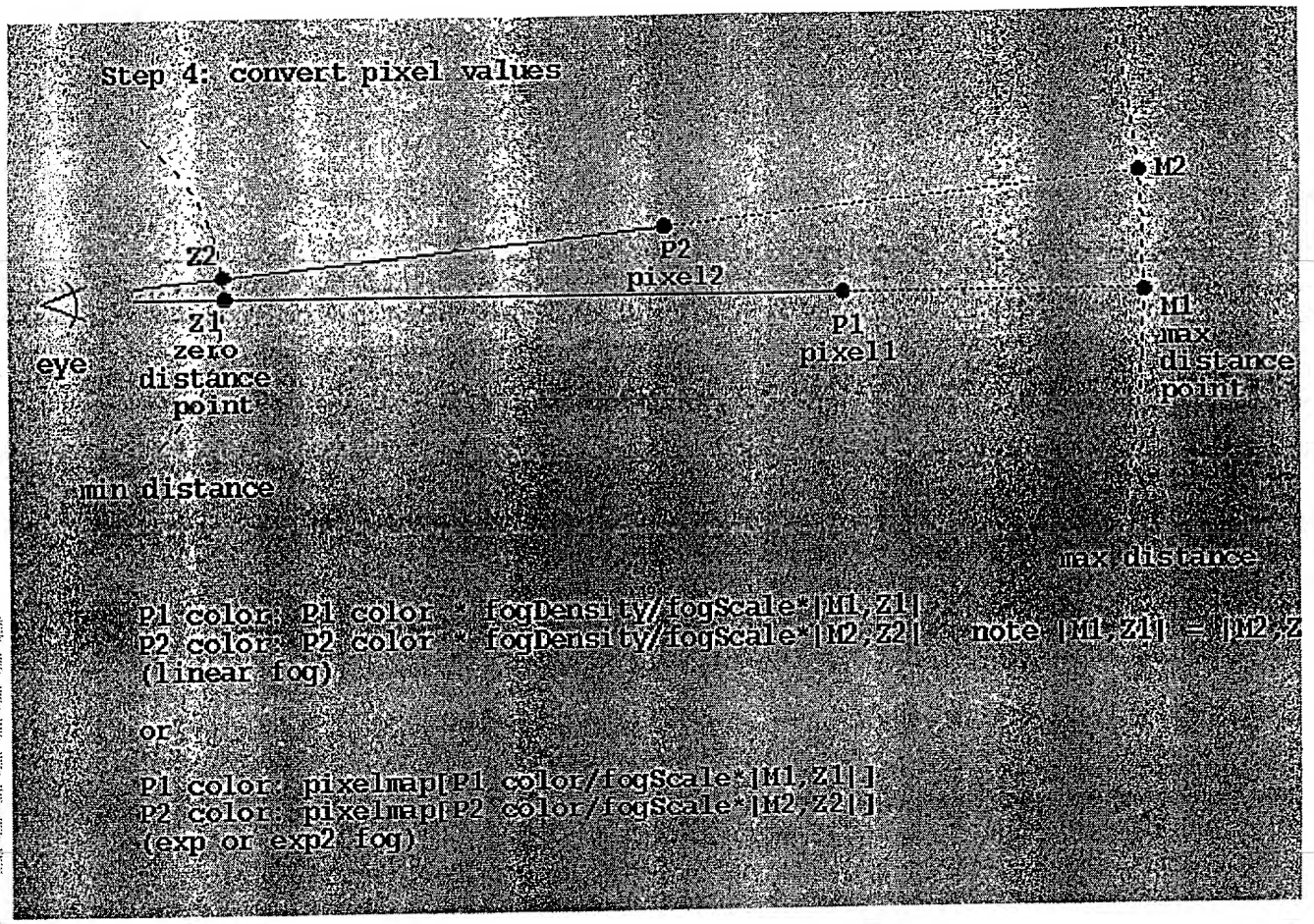
Step 4: convert pixel values
M2
Z2
P2
pixel2
Z1
zero
distance
point
eye
P1
pixel1
M1
MAX
distance
point
min distance
max distance
P1 color: P1 color * fogDensity/fogScale*|M1,Z1|
P2 color: P2 color * fogDensity/fogScale*|M2,Z2| note |M1,Z1| = |M2,Z
(linear fog)
or
P1 color: pixelmap[P1 color/fogScale*|M1,Z1|]
P2 color: pixelmap[P2 color/fogScale*|M2,Z2|]
(exp or exp2 fog)

FIG. 13E

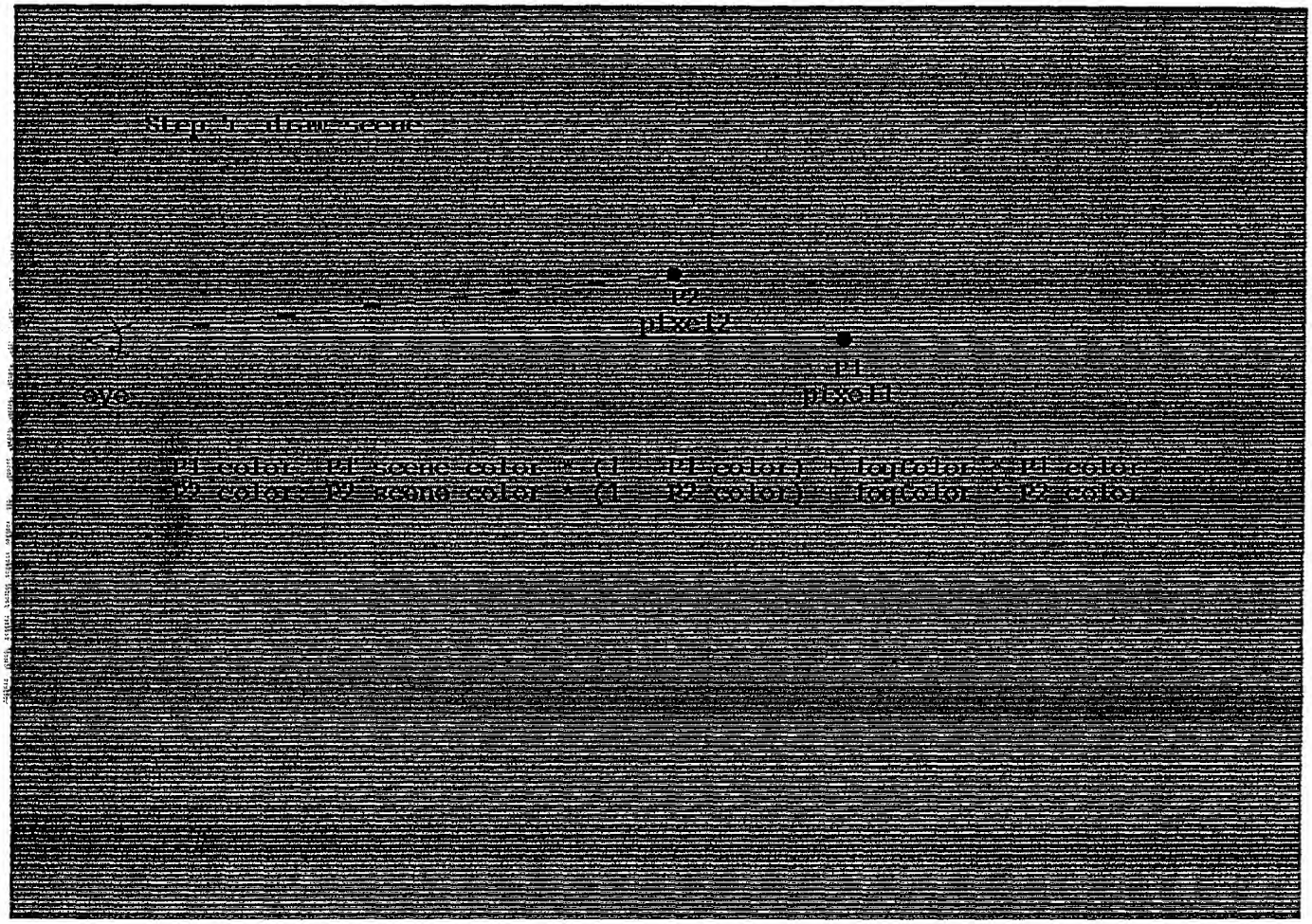
Step 1: draw scene
P2
pixel P2
P1
pixel P1
eye
P1 color = P1 scene color * (1 - P1 color) + fogColor * P1 color
P2 color = P2 scene color * (1 - P2 color) + fogColor * P2 color

FIG. 13F